FRDA Memo

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Root Disease Assessment In Coastal Backlog Areas - Project 2.28

SUMMARY

In coastal stands scheduled for rehabilitation, foresters can determine laminated root rot hazard ratings using a Survey Decision Guidelines form. Depending on stand and site features, either a post-harvest or pre-harvest survey technique can be used to indicate whether or not a site should be treated for laminated root rot.

INTRODUCTION

Coastal Douglas-fir plantations, on areas previously covered by fir types, risk infection by Douglas-fir laminated root rot, caused by the fungal pathogen *Phellinus weirii* (Murr.) Gilbertson. The disease spreads by mycelia from infected stumps or trees contacting the roots of healthy trees (Figure 1). Thus, incidence of root disease increases with continual rotations of susceptible conifer species.

Coastal areas with non-commercial cover, which are considered for rehabilitation under the Forest Resource Development Agreement (FRDA), ideally should be planted to Douglas-fir. However, these areas have often been previously covered with infected Douglas-fir. Information on the hazard of laminated root rot will facilitate more effective rehabilitation treatments.

This Memo describes the development and testing of a site evaluation procedure for laminated root rot assessment in coastal rehabilitation areas (Project 2.28).

FIGURE1. Profile of disease spreading from an infected stump to healthy trees.

DEVELOPMENT OF SURVEY METHODS

1. Factors Related to the Spread of the Disease

The three factors most related to spread of the disease are second growth stand composition, time since last harvest, and soil conditions.

- **Second growth stand composition** - Douglas-fir and true firs are the most susceptible species. Other coniferous species are infected to a varying extent (Figure 2). Neither western redcedar nor deciduous species are susceptible to laminated root rot.

Species:	Fd,Bg,Ba	Hw	Pl,Pw	Cw,D,Ep,Ac,Mb
Susceptibility:	High	Mod	Low	Very low to immune

FIGURE 2. Species susceptibility to laminated root rot.

- **Time since last harvest** - Research and field observations indicate that the viability and extent of the pathogen in stumps decrease sharply between 20 and 50 years after harvest, and that risk of spread is very low after this time (Figure 3). As competing soil organisms take over and the roots and stump decay, the pathogen retreats to the area around the root collar. The pathogen may also survive longer in the deep roots where it is not a threat to seedling root systems.

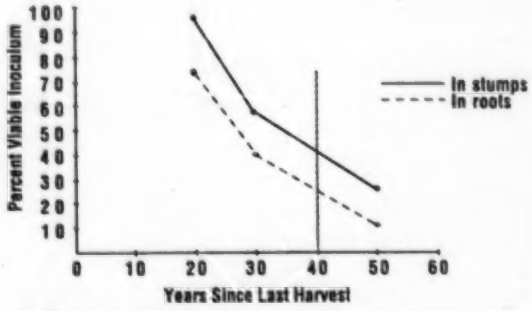

FIGURE 3. Laminated root rot decay curve.

- **Soil conditions** - Survival and spread of laminated root rot are greatest under dry to fresh soil moisture conditions. Poorly drained areas, or areas with thick clay soils, are not favourable to this disease. Site nutrient regime has not been linked to the incidence or spread of the pathogen.

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2. Determination of a Hazard Rating

A hazard rating system that ranks stands in terms of risk of infection and, consequently, priority for surveying, was developed based on the above three factors. This information is presented on the form, *Decision Guidelines for Coastal Rehabilitation Area Laminated Root Rot Surveys* (Figure 4).

3. Choice of Survey Technique

Mixtures of susceptible and non-susceptible species and the clumpy nature of stocking on many rehabilitation sites preclude the use of the standard pre-harvest root rot survey technique which is intended for use in even-aged, uniformly stocked stands of Douglas-fir. The post-harvest survey is an effective alternative for rehabilitation areas. In a post-harvest setting, the decay columns are clearly visible so that infection in both first and second growth stumps is easily identified.

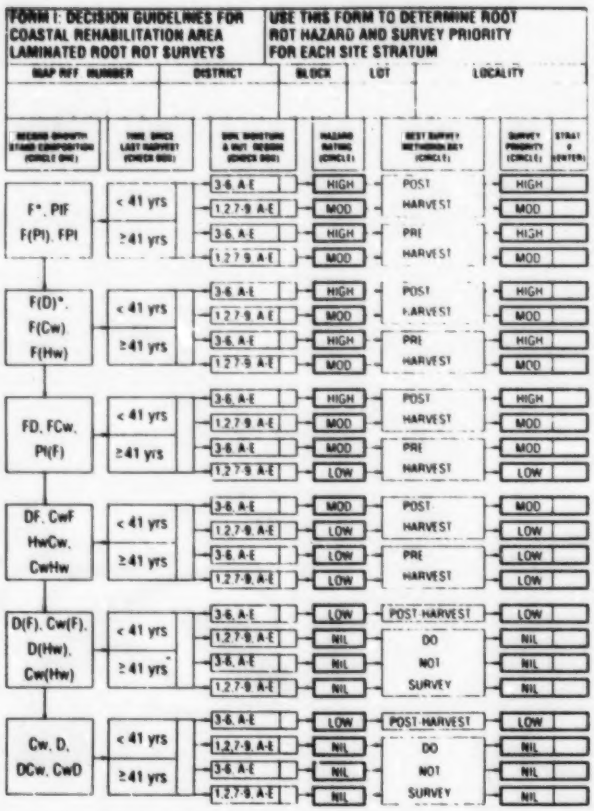
This project developed and refined the post-harvest survey procedures and Decision Guidelines Form and tested them for reliability and productivity. The need for perimeter disease surveys was also examined.

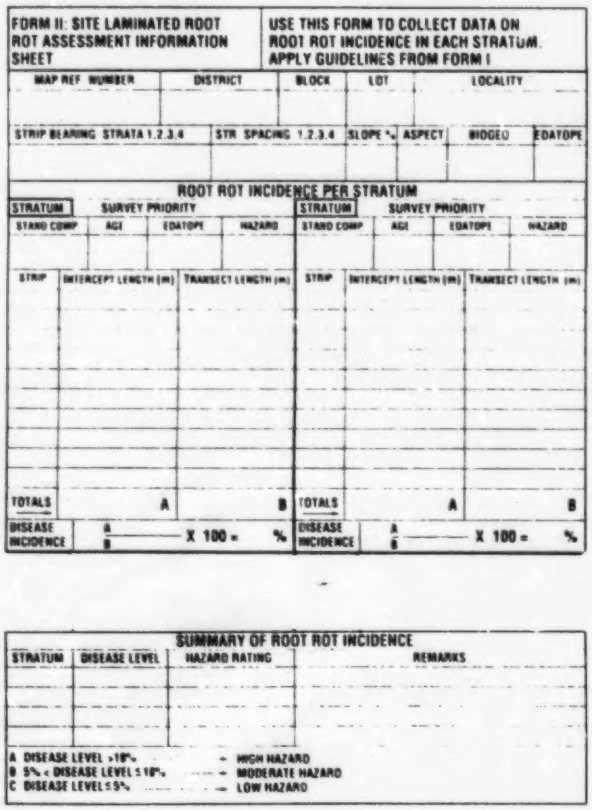
FIELD ASSESSMENT OF THE POST-HARVEST SURVEY TECHNIQUE

Initial field assessments have confirmed the effectiveness of the site assessment procedure. Disease incidence was correlated with the stand and site features: on areas that were designated as "nil" for disease hazard potential and survey priority, disease incidence was consistently low; on areas described as "low" or "moderate" actual pathogen levels were from "low" to "high"; and areas considered as "high" hazard potential and survey priority also had consistently high disease incidence.

Where susceptible species formed more than a minor portion of the stratum, disease levels were highly variable. This reflected the amount of root disease present in the first-growth, the percentage of susceptible species in the second growth, and the patchiness of species distribution.

In cases where Douglas-fir formed a minor component of the stand, but occurred in patches, the probability of root contact and subsequent inoculum transfer to the whole clump was much higher than if roots of susceptible and non-susceptible conifer species were mixed.





SUMMARY OF ROOT ROT INCIDENCE
STRATUM
DISEASE LEVEL
HAZARD RATING
REMARKS
A DISEASE LEVEL >10% → HIGH HAZARD
B 5% < DISEASE LEVEL ≤ 10% → MODERATE HAZARD
C DISEASE LEVEL ≤ 5% → LOW HAZARD

FIGURE 4. Decision guidelines and information sheet for laminated root rot for coastal rehabilitation areas.

Perimeter disease levels and on-site disease levels were not correlated. However, high disease levels on the edge of a cutblock would be important if the site were replanted with susceptible species. **Management options, such as planting at a reduced stocking along the perimeter, should be used for areas with high disease incidence at the perimeter.**

Productivity for a two person crew using the post-harvest survey technique was 24 to 30 ha per day. Productivity decreased by 20% under conditions of moderate to heavy slash and by 50% in heavily infected areas where transects spaced 25 m apart were required.

The post-harvest and pre-harvest survey techniques provided equally reliable estimates of disease incidence.

Selection of a survey technique can be guided by the Survey Decision Guidelines form. However, because both the pre- and post-harvest techniques have some advantages and disadvantages, a comparison of characteristics was made (Table 1). This will help foresters identify the technique most suitable for a particular rehabilitation area.

TABLE 1. Comparison of pre- and post-harvest root rot survey characteristics for rehabilitation areas

	Pre-harvest	Post-harvest
PURPOSE	- designed for use in uniformly stocked, even aged stands of Douglas-fir, especially for mature forests.	- designed for areas with patchy species distribution and a mix of susceptible and non-susceptible species where first-growth stumps pose a threat of root rot infection.
IDENTIFICATION OF THE DISEASE	- disease is very easily located in the stand when susceptible species are present because standing and windblown indicators are obvious. - infection in first-growth stumps is very difficult and time consuming to locate because of brush and decayed wood around the intact centers of the stumps.	- disease is easily located and identified in first- and second-growth stumps because infection columns are readily visible. - alert, trained surveyors are required to locate and correctly identify the pathogen since there are no standing or windblown indicators. - brush and excess decayed wood are usually removed in logging so the infection centers are visible.
RELIABILITY	- disease identification is not always possible in standing trees exhibiting reduced growth. Other root disease pathogens cause similar symptoms of reduced growth and thin crowns.	- landings and roads may cover infection centers. - identification of the disease in stumps is relatively easy.
MEASUREMENT OF INFECTION LENGTH	- along the transect lines, the distance from the last healthy tree intercepted to the first healthy tree encountered beyond an infection centre is recorded as the infection length. Infected trees must be adjacent to these healthy trees. - small clumps of healthy-appearing trees within infection centres are ignored.	- along the transect lines, the distance between the first and last infected stump encountered in an infection center, plus 5 m on each end, is recorded as the infection length. A 10 m infection length is recorded for single infected stumps. - small clumps of healthy-appearing trees within infection centres are ignored.
PRODUCTIVITY EASE OF MOVEMENT	- brush conditions can impede movement and decrease visibility.	- heavy slash can impede movement and cause some stumps to be missed.
COORDINATION WITH OTHER ACTIVITIES	- does not require close coordination with logging activities. - Pre-harvest root rot surveys are easily coordinated with pre-harvest silviculture prescription surveys.	- requires close coordination with logging activities since location and identifiction of the pathogen become more difficult with time and are **impossible after broadcast burns.** - Pre-harvest silviculture prescription surveys require a separate visit before logging occurs.

More Information:

A pamphlet and video describing the survey technique in more detail, are available, along with the necessary survey forms from Protection Branch, Victoria.

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